## REMARKS

Reconsideration and continued examination of the above-identified application are respectfully requested.

The claims have been amended as described in more detail below. No search is necessitated by this amendment and no new questions of patentability should arise, since the scope of this subject matter has already been examined by the Examiner. No new matter has been added. Finally this amendment places the application in condition for allowance. Therefore, entry of this amendment is respectfully requested.

Applicants have discovered that the Fee Transmittal form filed with the previous response listed an incorrect number of independent claims, and this was not recognized by the Patent Office. Applicants have corrected this inadvertent oversight on the attached Combined Amendment and Petition for Extension of Time, showing the correct number of claims and corresponding fees.

## Pending Claims

Claim 1 has been amended in order to more clearly describe Applicant's invention. In particular, claim 1 now specifically recites that the product of the disclosed process is a material with interpenetrating organic and inorganic networks on a scale of no more than 100 nm, as stated in the preamble. Claims 1-9, 12-13, 15-16, and 20-36 are pending.

## Summary of the Invention

The present invention relates to materials with interpenetrating organic and inorganic networks with a maximum dimension of 100 nm as well as to a process for the production of such materials. Processes for the preparation of materials comprising these products are also disclosed.

**Rejection of Claims under 35 U.S.C. § 102(e)**

The Examiner has rejected claims 1, 3, 4, and 7-9 as being anticipated by Harmer (U.S. Patent No. 5,824,622). Applicants disagree.

In paragraph 2 of the Final Office Action, the Examiner incorporates the discussion of the disclosure of Harmer from paragraph 4 of the Office Action mailed August 4, 2004. On pages 3-4 of the Final Office Action, the Examiner summarizes Applicants' previous argument concerning Harmer that a) this reference fails to disclose an organic-inorganic network on a scale of no more than 100 nm and b) this reference fails to disclose a process for making such a material.

Regarding argument a), the Examiner states that Harmer clearly discloses networks of porous silica having fluorinated polymer diffused into the silica component. The Examiner further states that, while Harmer may not refer to it as an interpenetrating network, this is a basic definition of it. Regarding argument b), the Examiner states that the process disclosed in the broadest claim of the present invention are exactly the same steps taught by Harmer and therefore is bound to produce the same product, including properties such as density.

Regarding claims 1, 3, 4, and 7, as amended, claim 1 relates to a process for the production of a material with interpenetrating organic and inorganic networks comprising three steps. In step (1) of this process, aqueous solutions or dispersions of organic polymer, polymer precursors, or mixtures thereof which are capable of forming networks are mixed with silicon dioxide compounds. In step (2), a gel is formed. This gel consists of interpenetrating organic and gel networks. In step (3), the gel is dried to produce a material with interpenetrating organic and inorganic networks. Thus, the process of claim 1 produces a material that has two interpenetrating networks – an organic network and an inorganic network.

As discussed in the first full paragraph on page 3 of the present application, it has been discovered that organic polymers or polymer precursors capable of forming organic networks under the conditions of the formation of aerogels and xerogels can be used in addition to the

inorganic starting materials used for the production of aerogels and xerogels. Examples of these conditions are discussed in the first paragraph on page 10, which teaches that the interpenetrating networks form during the gel formation step by changing the pH and/or by subjecting to a thermal treatment. One network may form ahead of the other, or both can form simultaneously.

With respect to the organic network, the last paragraph on page 3 of the present application states that the term " polymer" is understood to be a polymer, a polycondensate, or a polyadduct which can be crosslinked in water (see the last paragraph on page 3). The first full paragraph on page 4 discloses that preferably the organic polymer network is obtained by polycondensation. Thus, the phrase " polymer network" as used in the present application does not relate to a dispersion or dilution of a polymer in a second phase. Instead, only organic polymers, polymer precursors, or mixtures thereof capable of forming polymer networks are relevant. Therefore, it is clear that the process of claim 1 results in the formation of a material having two networks, including an organic polymer network, rather than a mixture of a polymer within a silica gel network.

By comparison, Applicants believe that Harmer does not describe a process which results in the production of a material having two networks that are interpenetrating but instead relates to a process for the preparation of a material that is a mixture of a polymer in an inorganic network. Harmer relates to porous microcomposites comprising a perfluorinated ion exchange polymer (PFIEP) containing pendant sulfonic acid and/or carboxylic acid groups. The PFIEP is disclosed to be entrapped within and highly dispersed throughout a network of silica and/or metal oxide (for example, see the abstract of Harmer). In addition, column 7, lines 31-35 of Harmer discloses that the microcomposite consists of a continuous metal oxide phase which entraps a highly dispersed PFIEP. Therefore, the microcomposites resulting from any method described in Harmer do not have a network of polymer and a network of silica but rather have a polymer entrapped or dispersed within a silica network. There is no polymer network formed, as the term is used in the present invention, since PFIEP does not undergo a network forming reaction, including, for example, crosslinking or polycondensation described in the present invention. Therefore, unlike the process of the present invention, any process disclosed in Harmer does not

result in the preparation of a microcomposite having an interpenetrating organic and inorganic network.

Applicants believe that the microcomposites resulting in Harmer fall into the same category as those produced by the process of U.S. Patent No. 5,342,876, which is discussed in the paragraph spanning pages 1 and 2 of the present application. For U.S. Patent No. 5,342,876, no interpenetrating network of silicon dioxide and polyacrylamide is formed, meaning that " the polyacrylamide can be dissolved out of the article produced". The polyacrylamide is part of the silicon dioxide body, but " it is not a component of an organic-inorganic network". Thus, no polyacrylamide organic network is formed by any process described in U.S. Patent No. 5,342,876. In the same way, the PFIEP of Harmer is entrapped within and highly dispersed throughout a network of silica and/or metal oxide, but no PFIEP network is formed, as the term is used in the present invention.

Applicants therefore believe that claim 1 is not anticipated by Harmer. Claims 3, 4, and 7, which depend directly from claim 1, disclose further embodiments of the present invention and, for at least the reasons discussed above, are also not anticipated by Harmer.

Regarding claim 8, this claim relates to materials with organic and inorganic networks that are produced by the process of claim 1. As discussed in more detail above, the microcomposite of Harmer is not the same as the product produced by the process of the present invention since the microcomposite of Harmer does not include both an organic and an inorganic network. Applicants therefore believe that claim 8 is not anticipated by Harmer.

Regarding claim 9, this claim relates to an aerogel consisting of organic and inorganic networks. As discussed in more detail above, the microcomposite of Harmer is not the same as the aerogel of the present invention since the microcomposite of Harmer does not include both an organic and an inorganic network. Applicants therefore believe that claim 9 is not anticipated by Harmer.

Therefore, Applicants believe that claims 1, 3, 4, and 7-9 are not anticipated by Harmer and respectfully requests that the rejection be withdrawn.

**Rejection of Claims under 35 U.S.C. § 103**

The Examiner has rejected claims 2, 12, 13, 15, 16, 20, 21, 23, 24, and 29-36 as being unpatentable over Harmer (U.S. Patent No. 5,824,622) in view of Koloski (U.S. Patent No. 5,977,241). Applicants disagree.

In paragraph 4 of the Final Office Action, the Examiner incorporates the discussion of the disclosure of Harmer and Koloski from paragraph 8 of the Office Action mailed August 4, 2004. The Examiner has also rejected claims 32-36, stating that column 26, Example 9 of Koloski discloses the use of a composition as a coating. In addition, on pages 4-5 of the Final Office Action, the Examiner summarizes Applicants' previous argument concerning Koloski that c) this reference discloses microcomposites similar to that of Harmer, having polymer entrapped within the solid matrix and d) this reference discloses a process for forming the microcomposite, which comprises polymerization of the infused molecules but does not disclose interpenetrating networks.

Regarding argument c), the Examiner agreed. Regarding argument d), the Examiner states that Koloski was utilized to provide for types of polymers that can form the composite and for their uses, but not for its process. However, the Examiner further states that Koloski clearly discloses that such compositions can be made utilizing other methods, including a method in which inorganic and organic components are dissolved in a solvent in which they are both miscible. The Examiner finally asks why it would not have been obvious to use the polymers of Koloski in the prior art of Harmer, especially when they are both capable of forming similar products.

Applicants believe that the Examiner has misunderstood the arguments presented in their previous response regarding Koloski. In section IV, page 14, third paragraph of the response filed on October 29, 2003, Applicants stated that "the composites of Koloski are similar to the microcomposites of Harmer in that each contains **molecules** infused into or entrapped within a matrix" [empahsis added]. Applicants did not define these molecules as polymer, as was

interpreted by the Examiner. Thus, Applicants merely meant to point out that the products of Koloski are similar only in a very general way to those of Harmer.

In fact, Applicants went further to state that the composites of Koloski are made by evacuating the free volume of a polymer matrix and infusing inorganic and organic molecules into the evacuated free volume. These products are not the same as those of Harmer. As discussed in more detail above, Harmer teaches a microcomposite comprising a perfluorinated ion exchange polymer (PFIEP) containing pendant sulfonic acid and/or carboxylic acid groups that are entrapped within and highly dispersed throughout a network of silica and/or metal oxide. Thus, the microcomposites of Harmer do not contain an organic and an inorganic network, as the term is used in the present invention, but rather a polymer dispersed with an inorganic network. By comparison, Koloski teaches a composite including a polymer matrix having an inorganic or organic material disposed in the natural free volume of the polymer matrix. The inorganic or organic material can be polymerized, thereby forming a network. Thus, in some embodiments, Koloski teaches a composite having both an organic and an inorganic network. Since Harmer teaches a polymer dispersed in an inorganic network while Koloski teaches an inorganic domain dispersed in a polymer network, Applicants believe that the products of Harmer and Koloski are very different materials.

Regarding claim 2, this claim relates to a process for the production of a material with interpenetrating organic and inorganic networks comprising three steps. In step (1) of this process, aqueous solutions or dispersions of organic polymer, polymer precursors, or mixtures thereof which are capable of forming networks are mixed with silicon dioxide compounds. The organic polymers, polymer precursors, or mixtures thereof are based on formaldehyde or formaldehyde-containing resins, polyvinyl alcohol, or poly(meth)acrylates. In step (2), a gel is formed. This gel consists of interpenetrating organic and gel networks. In step (3), the gel is dried to produce a material with interpenetrating organic and inorganic networks. Thus, the process of claim 1 produces a material that has two interpenetrating networks – an organic network and an inorganic network.

As discussed in more detail above, Harmer teaches a process for the production of a material that is a mixture of a polymer in an inorganic network. This method involves the steps of combining a PFIEP and a source of silicon oxide in a common solvent, changing the pH, and gelling (see column 5, line 59 to column 6, line 37).

By comparison, Koloski describes a method for the preparation of a composite that is different from that of Harmer in which the free volume of a polymer matrix is evacuated and inorganic or organic molecules are infused into the evacuated free volume (see column 4, lines 41-43 of Koloski). A wide variety of polymer matrixes are taught (see column 5, line 21 to column 7, line 35), and the inorganic material can itself form three dimensional networks within the polymer matrix' s natural free volume (see column 9, lines 19-21). Thus, the method of Koloski results in the formation of a material having two networks.

Thus, the method that is taught by Koloski is entirely different from the method taught by Harmer, and both methods result in very different products. Therefore, Applicants believe that these references cannot be combined, and one skilled in the art would not use the polymers taught by Koloski in place of the PFIEP of Harmer.

Furthermore, Applicants believe that combining the polymers of Koloski to form the microcomposites of Harmer goes against the very teaching of Harmer. Harmer does not teach or suggest that any polymers other than PFIEP' s can be used to prepare the microcomposites, and therefore, one skilled in the art would not be motivated to replace the polymer of Harmer' s microcomposite. Finally, even if one were to use a polymer from Koloski in place of the PFIEP of Harmer, the only types of polymers that would be selected would be those that did not form networks since the microcomposite of Harmer does not comprise a polymer network, as the term is used in the present application. This is not the method of the present invention. Therefore, Applicants believe that claim 2 is patentable over Harmer in view of Koloski.

Regarding claims 12, 13, 15, 16, 20, 21, 23, 24, and 29-36, each of these claims relates to the use of or a method to use a material prepared by the method of the present invention. Thus, each of these claims either recites the method steps of claim 1 or preferred embodiments of this method, or is dependent upon a claim that recites these steps. As discussed in more detail

above, the products recited in these claims, prepared by the method of the present invention, differ from those resulting from the method taught in Harmer. Also as discussed in more detail above, the method of Koloski cannot be combined with that of Harmer and therefore cannot cure the deficiencies of this reference. In addition, even if one were to combine these references, the polymers that would be chosen from the lists provided in Koloski would only be those that did not form polymer networks, since the polymer used in Harmer is such a polymer. This is not the method of the present invention. Therefore, Applicants believe that claims 12, 13, 15, 16, 20, 21, 23, 24, and 29-36 are patentable over Harmer in view of Koloski.

Thus, Applicants believe that claims 2, 12, 13, 15, 16, 20, 21, 23, 24, and 29-36 are patentable over Harmer in view of Koloski and respectfully request that the rejection of these claims be withdrawn.

## Conclusion

In view of the foregoing amendments and remarks, Applicant believes that this application is considered to be in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would further expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

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